Frontenac, La Crescent, and Marquette Crop Load Trials in Wisconsin

Vernon County, WI
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Background and Rationale: Grape production in Wisconsin has experienced an exponential growth due to the introduction of new cold-hardy grape cultivars, which has made possible the establishment of vineyards and wineries in areas previously thought too cold to grow grapes. Even though these new varieties are able to survive the harsh winters of Wisconsin, the short growing seasons and low accumulation of growing degree-days in northern regions can result in low fruit quality. Cluster thinning, a canopy management technique that decreases the number of clusters per vine, could potentially increase fruit quality by favoring the partition of photosynthate towards a smaller crop load, which could influence fruit chemistry and overall quality. The following trial was established to study the effect of pre-bloom and post-bloom cluster thinning on fruit quality of 'Frontenac', 'La Crescent', and 'Marquette' in Wisconsin.

Treatments: In 2015, vines were randomly selected within established blocks at Vernon Vineyards, a commercial vineyard located in Vernon County, Wisconsin (43.6N, 90.58W). All varieties were trained in a high wire cordon. 'Marquette', 'La Crescent', and 'Frontenac' were planted in 2004, 2008, and 2011, respectively. 'Marquette' and 'La Crescent' are spaced with 10ft (3.05m) between rows and 8ft (2.44m) between vines, and trained to a 5ft (1.52m) top wire. 'Frontenac' vines were spaced with 9ft (2.74m) between rows and 8ft (2.44m) between vines, and trained to 5.5ft (1.68m) top wire. All varieties were shoot thinned to six shoots per foot of cordon at 5" shoot growth.

- **Control:** Vines were thinned pre-bloom to a standard two clusters per shoot.
- **25% Pre-bloom:** 25% of inflorescences per vine were removed prior to bloom.
- **25% Post-bloom:** 25% of clusters per vine were removed after fruit set.
- **50% Post-bloom:** 50% of clusters per vine were removed after fruit set.

Methods: Throughout the growing season, vines were maintained under best management practices (pre-bloom shoot thinning, post-bloom shoot positioning, post-bloom lateral shoot removal, and leaf removal around the cluster zone). Berries were sampled for fruit quality (10 berries per vines) starting July 30th (pre-veraison) until harvest (Dates: 'La Crescent' 9/13, 'Marquette' 9/20, 'Frontenac' 9/30, 2015). Brix, Titratable Acidity (TA), and pH levels were recorded for each sampling date. At harvest total yield per vine, number of clusters per vine and cluster weight was recorded for each treatment.

Results:
The 50% cluster removal post-bloom significantly affected yield and number of clusters per vine in 'Marquette' and 'Frontenac', compared with the control (Table 1). No significant differences in yield were observed for any of the treatments in 'La Crescent', however cluster weight was significantly higher in the control treatment (Table 1). 'La Crescent' vines had a poor fruit set during 2015 due to wet and cold weather conditions; this may have affected the results of the treatments.

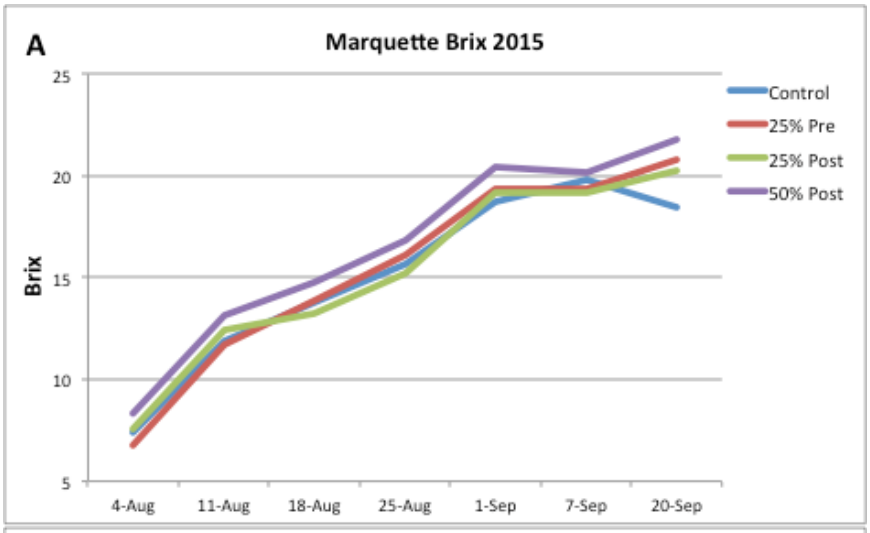
During 2015, 'Marquette' vines under 50% post-bloom thinning treatment had significantly higher Brix ($p<0.0001$) than pre-bloom treatments and control (Fig. 1A). Over the fruit sample period TA levels were significantly higher ($p=0.039$) in the 25% pre-bloom treatment compared to the 25% post-bloom thinning (Fig 2A). Brix in 'Frontenac' were significantly lower in the control treatment ($p=0.0006$) compared with all the thinning treatments (Fig. 1C). No significant differences were observed for any of the treatments in 'La Crescent' (Fig 1B; 2B)

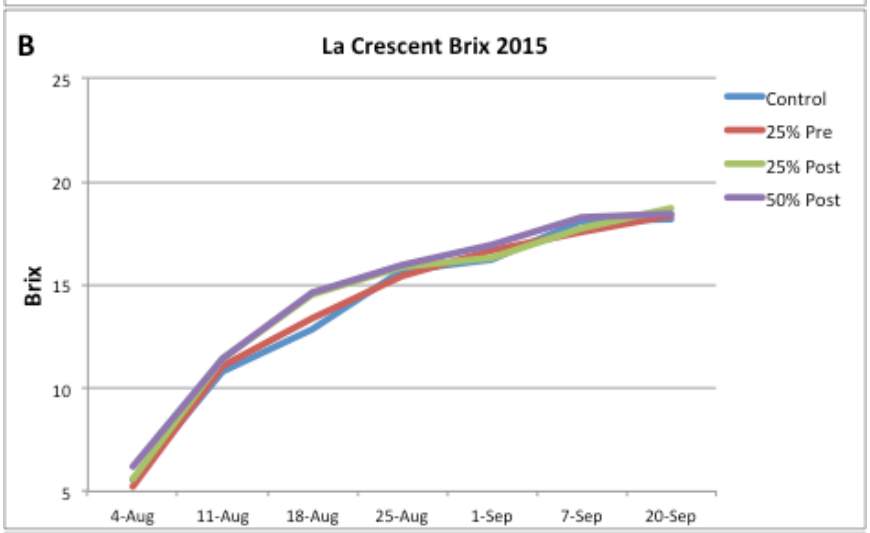
Table 1. Yield (kg/vine), number of clusters, and cluster weight (g) at harvest under different crop load treatments for 'Marquette', 'La Crescent', and 'Frontenac' trial, Vernon County, WI, 2015.

	Treatment	Yield (kg/ Vine)	Number Cluster/Vine	Average Cluster Weight (g)
MARQUETTE	Control	6.09 a	74.44 a	82.56
	25% Pre	4.16 b	46.67 bc	87.81
	25% Post	4.41 b	55.22 b	83.28
	50% Post	2.81 c	35.56 c	79.12
LA CRESCENT	Control	6.98	58.22 a	116.24 ab
	25% Pre	4.68	39.67 b	115.45 ab
	25% Post	5.13	46.80 b	108.97 b
	50% Post	5.35	41.22 b	127.92 a
FRONTENAC	Control	12.22 a	75.11 a	164.09 ab
	25% Pre	10.74 a	60.78 bc	177.91 a
	25% Post	10.87 a	72.22 ab	151.01 b
	50% Post	7.55 b	48.89 c	155.44 b

Means followed by the same letter within column and variety are not significantly different at α=0.05. Columns where no letters are present indicate no significant differences among treatments.

Figure 1. Soluble solids (Brix) development throughout the growing season for 'Marquette' (A), 'La Crescent' (B), 'Frontenac' (C) at Vernon Vineyard, Vernon County, Wisconsin.





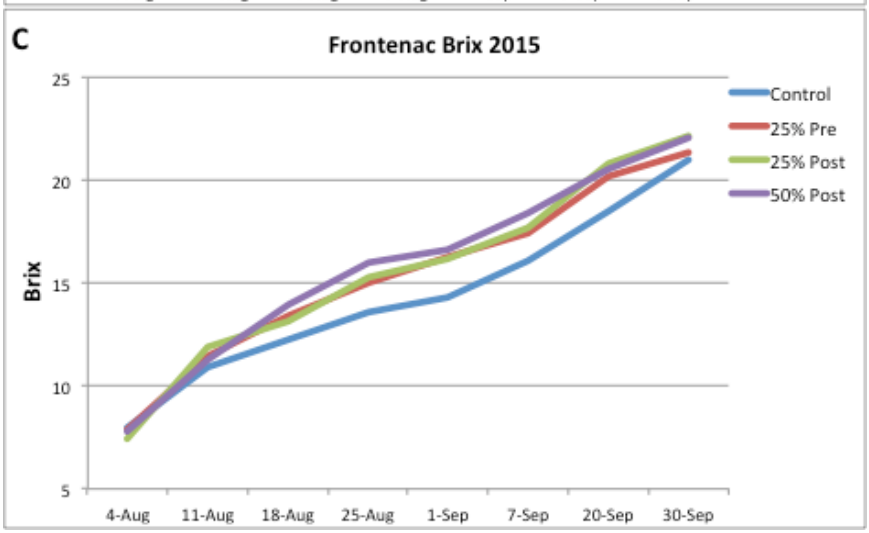
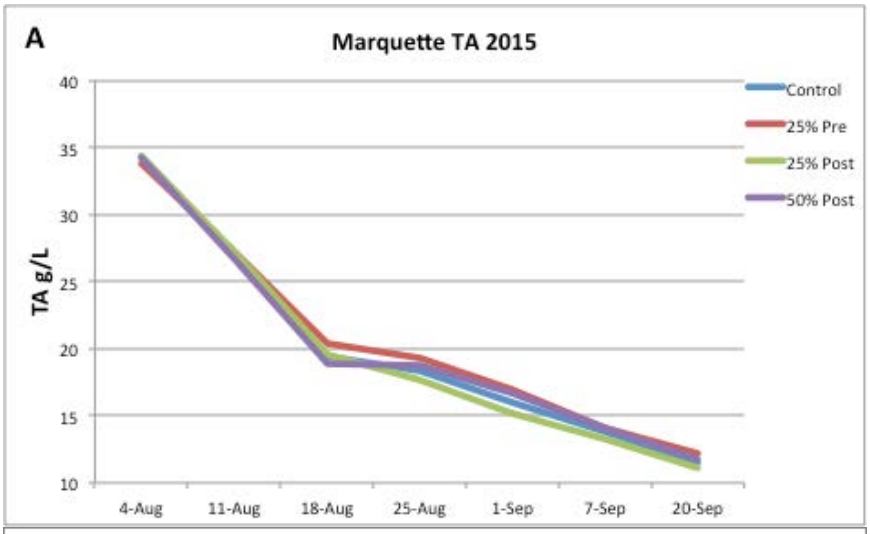
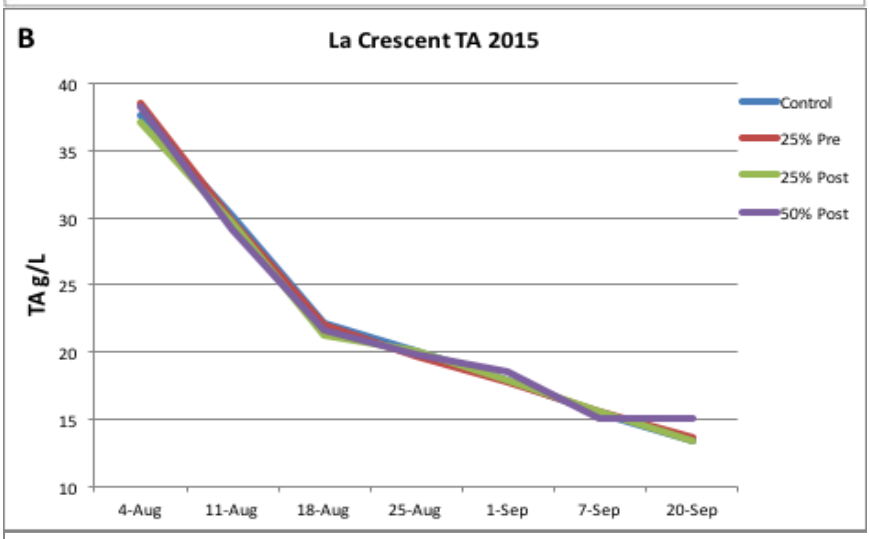
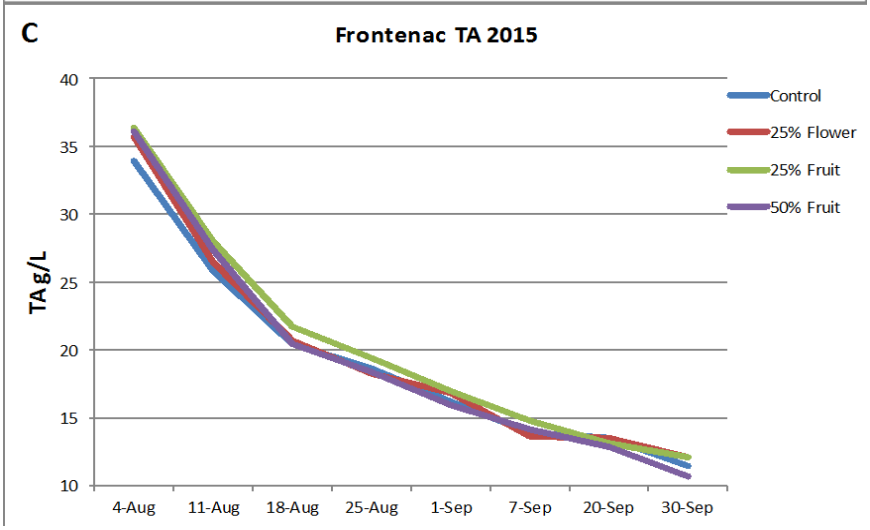


Figure 2. Titrateable Acidity (TA) (g/L) development throughout the growing season for 'Marquette' (A), 'La Crescent' (B), 'Frontenac' (C) at Vernon Vineyard, Vernon County, Wisconsin.







What the results mean:

- The treatments affected fruit yield, with 50% post-bloom thinning significantly reducing yield in Frontenac and Marquette.
- Post-bloom thinning affected cluster weight in Frontenac, but not in Marquette.
- Treatment effects in La Crescent for 2015 might have been affected by the low fruit set in all treatments due to cold and wet weather conditions around bloom time.
- Pre and post-bloom thinning treatments had a significant impact on Brix and TA during the fruit sample period. In Marquette, the 50% post-bloom thinning of cluster increased Brix levels, and in Frontenac all thinning treatments had significantly higher Brix than the control.
- Although there were significant differences in TA among treatments, there were no clear trends in any of the varieties.